

REMARKS

Claims 1-2, 4-5 and 7-11 are pending. No amendments to the claims are presented at this time. Rather, reconsideration of the application is requested in view of the remarks which follow.

Withdrawal of Rejections

Applicant thanks the Examiner for the withdrawal of the rejection to claims 1, 2, 5, and 7-11 in view of Vikar.

Claim Rejections under 35 USC §103

Claims 1 and 2 stand rejected under 35 USC §103(a) over Ivers-Tiffée et al. (*Journal of the European Ceramic Society*, 2001, pp. 1805-1811) in view of Bogicevic et al. (US 6,495,279).

Claims 1-2, 4-9 and 11 are considered in the Office Action to be product by process claims wherein the fuel cell only requires an electrolyte layer, an electrolyte boundary layer, and two electrodes. The electrolyte layer is yttrium or scandium doped zirconium dioxide.

Claim 4 stands rejected under 35 U.S.C. 103(a) over Ivers-Tiffée et al. in view of Bogicevic et al. as applied above to claim 1, and further in view of Herbstritt et al. (Cathode Performance: Influence of MOD-Intermediate Layer and Electrolyte Surface Enlargement, *Proceedings of the Fourth European Solid Oxide Fuel Cell Conference*, 10th – 14th July 2000, Lucerne, Switzerland, 2000, pp. 697-706).

Claims 5, 8 and 11 stand rejected under 35 U.S.C. 103(a) over Ivers-Tiffée et al. in view of Bogicevic et al. as applied above to claim 1, and further in view of Herbstritt et al. (Increased Cathode Performance using a Structured Electrolyte Surface, *Electrochemical Society Proceedings*, Volume: 99-19, 1999, pp. 972-980, hereinafter Herbstritt 2).

Claim 7 stands rejected under 35 U.S.C. 103(a) over Ivers-Tiffée et al. in view of Bogicevic et al. as applied above to claim 1, and further in view of in view of Chen et al. (US 6,645,656 B1).

Claim 9 stands rejected under 35 U.S.C. 103(a) over Ivers-Tiffée et al., Bogicevic et al. and Chen et al. as applied to claim 7 above, and further in view of Herbstritt 2.

Claim 10 stands rejected under 35 U.S.C. 103(a) over Ivers-Tiffée et al. in view of Herbstritt 2, Bogicevic et al. and Van Berkel et al. (US 2002/0031694 A1).

The various rejections are amply discussed in the Office Action. For the sake of brevity, the Office's position is not reiterated here and the rejections are discussed in combination.

Each of the rejections is traversed. The cited references, even in the noted combinations, do not teach or suggest the features of the invention in any manner sufficient to sustain the rejections.

The Office Action asserts that the high-temperature solid electrolyte fuel cell according to claim 1 is obvious over Ivers-Tiffée et al. in view of Bogicevic et al. Dependent claims are variously rejected in view of additional references. The Examiner recognizes that Ivers-Tiffée et al. fail to disclose an electrolyte boundary layer as recited in claim 1, but takes the position that such an electrolyte boundary layer is disclosed by Bogicevic et al. (in particular, at column 2, lines 57 to 59). Applicant respectfully disagrees.

The Applicant respectfully submits that the "interlayer" referred to by Bogicevic et al. having a thickness of up to 1 micron (1000 nm) and being applied by an unspecified method, on a smooth surface is not equivalent or even comparable to the electrolyte boundary layer according to the present invention, **which is applied by an MOD process on a screen-printed, i.e. structured electrolyte layer**. This claimed method of application of the interlayer is not an arbitrary choice as suggested in the Office Action by the statement that claims 1-2, 4-9 and 11 are product by process claims. The method of

making the fuel cell and the method of the deposition of the interlayer are essential to the properties of the interlayer and the fuel cell, as discussed below. Deposition of the interlayer using other methods would not provide the fuel cell of the instant invention.

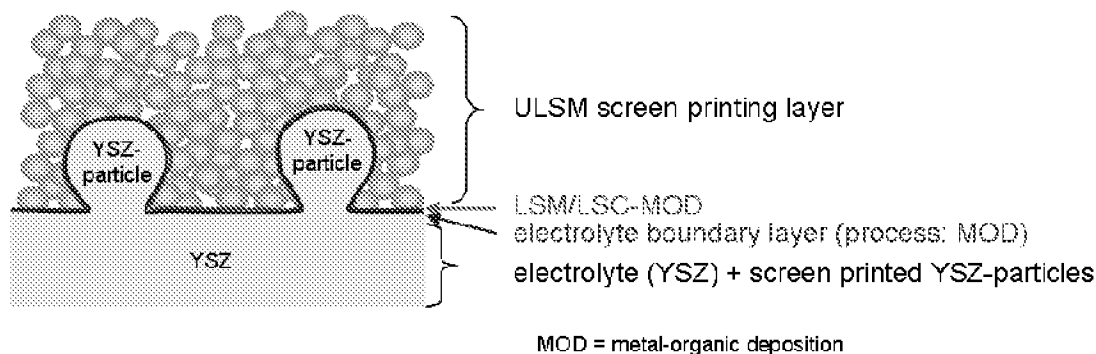
In particular, the interlayer referred to by Bogicevic et al. is not applied on a structured electrolyte surface. Further, Bogicevic et al. provide no information whatsoever as to the method by which such an interlayer should be applied. Contrary to the assertion in the Office Action, ***the method by which the electrolyte boundary layer is applied is of crucial importance to the structure and properties of the layer obtained.*** In fact, whether an electrolyte boundary layer having a thickness of 100 to 500 nm as recited in claim 1 is obtained at all depends on the appropriate selection for applying the layer. There is no teaching or suggestion in Bogicevic et al. as to how a structured layer of such thickness could be obtained.

Layers such as the interlayer referred to by Bogicevic et al. can, in principle, be applied to smooth surfaces by methods such as screen-printing, sputtering, physical vapor deposition (PVD), chemical vapor deposition (CVD), or sol-gel-processes. However, as explained herein, none of these methods would give an electrolyte boundary layer according to the presently claimed invention. The structure of the layer on which the electrolyte boundary layer is applied must be taken into consideration.

The interlayer described by Bogicevic et al. is applied on a ***smooth, i.e. unstructured, surface***, and prepared by microelectronics industry methods to manufacture transistor and other components (which are flat). The fuel cells of Bogicevic et al. contain gas channels, interconnects, and other regular structures. Bogicevic et al. do not teach or suggest the irregular surface of the fuel cell of the instantly claimed invention. Therefore, based on the teachings of Bogicevic et al., the claimed interlayer and claimed method of deposition of the interlayer of the instantly claimed invention is not rendered obvious. Note that Bogicevic et al. teach that “[a]n interlayer may be placed between either electrode and the electrolyte ...” without suggesting, let alone disclosing, that the electrode or electrolyte surface should be structured in any way.

The electrolyte boundary layer according to the presently claimed invention, on the contrary, is applied, as clearly recited in claim 1, on the structured electrolyte surface which results from screen-printing electrolyte particles on a (smooth) electrolyte substrate. The application of electrolyte particles to the (smooth) electrolyte substrate in step (i) of claim 1 results in a significant increase of the electrolyte surface because the individual screen-printed electrolyte particles protrude from the electrolyte surface. The increased surface area of the electrolyte serves to increase the contact area between the electrolyte and the nanoporous electrode thin layer which is subsequently applied. The electrolyte boundary layer is applied on the screen-printed, i.e. structured, electrolyte surface prior to applying the nanoporous electrode thin layer. **Therefore, in order to retain the enlarged surface, the electrolyte boundary layer must “copy” (i.e. reproduce) the structure of the screen-printed electrolyte layer on which it is applied.** Otherwise, the benefit of the increased surface area due to the screen-printed electrolyte particles would be lost. An electrolyte boundary layer having these properties can only be achieved by using the MOD process according to the presently claimed invention.

For further illustration, a schematic cross-sectional view of the electrolyte fuel cell according to the present invention is shown in the following figure. Note that the electrolyte boundary layer and the nanoporous electrode layer (i.e. an LSM/LSC-MOD cathode layer in the figure below) each form **a coherent layer covering the entire surface of the electrolyte substrate and the screen-printed electrolyte particles protruding therefrom.** (In order to do this, these layers must be so thin that they are hardly discernible in the figure below. The electrolyte boundary layer lies on top of the YSZ surface in a thin layer, which in turn, is overlaid by the LSM/LSC-MOD layer.) The top layer shown is the electrode layer (i.e. a ULSM layer in this example).



Thicker layers would cover and level out the structured electrolyte surface without “copying” its structure so that the enlarged surface would be lost. This would be contrary to the objectives achieved by the presently claimed invention. As noted above, the method of deposition of the interlayer as claimed is not an arbitrary distinction, but instead results in an interlayer with specific properties of the fuel cell of the invention (e.g., thickness, deposition of a coherent layer around the structures of the fuel cell).

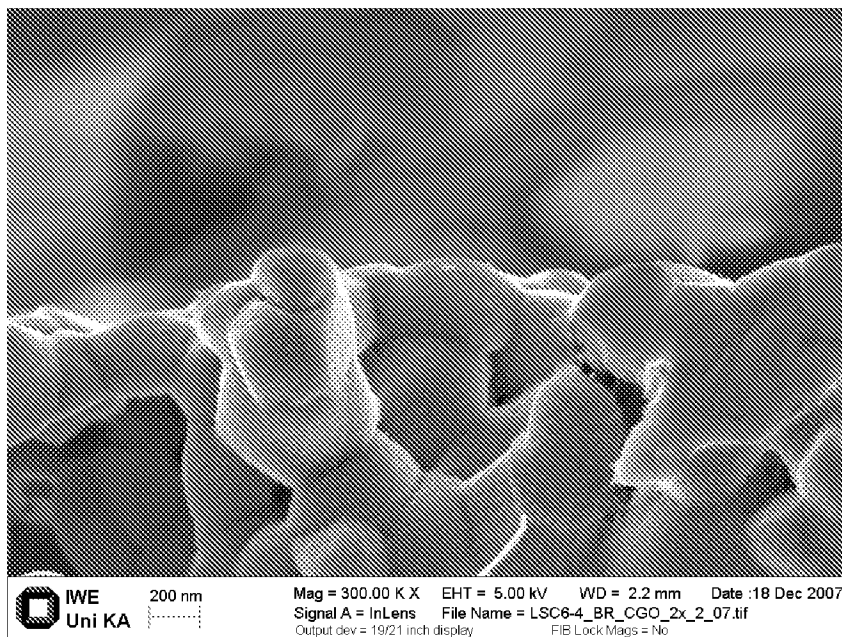
A process such as screen-printing ***necessarily results in layer thicknesses of more than 5 μm*** and would therefore be unsuitable for obtaining the structure according to the present invention as depicted in the above figure.

The aforementioned PVD, CVD or sputtering processes would result in thinner layers. However, ***these processes are not capable of covering the entire surface of the electrolyte particles***. In particular, due to masking effects of the particles themselves, deposition of a coherent layer around the bases of the particles (where the particles are in contact with the electrolyte substrate) could not be formed by PVD, CVD or sputtering processes.

Thus, it is clear that only the claimed MOD process according to the present invention is capable of producing an electrolyte boundary layer which coherently covers the entire surface of the electrolyte substrate and the screen-printed electrolyte particles without losing the increased surface area of the structured electrolyte surface. Therefore, in the absence of any guidance as to how the “interlayer” referred to by Bogicevic et al. is to be obtained, it cannot be assumed that that interlayer is

in any way comparable to the electrolyte boundary layer recited in claim 1 of the present application.

The following picture shows an MOD-LSC layer deposited according to the presently claimed invention on a structured electrolyte surface. As can be seen, the process according to the present invention results in the entire (inner and outer) porous surface of the electrolyte being coated with the electrolyte boundary layer and thus being available for contact with the electrode layer. The concept of an electrolyte boundary layer achieving this effect is neither disclosed nor suggested in any of the references cited, even in combination.



It follows from the above, that the “interlayer” referred to by Bogicevic et al., in the absence of any information as to how it is applied, cannot be equated with the electrolyte boundary applied on a structured electrolyte surface by an MOD process according to the present invention. Moreover, as the interlayer of Bogicevic et al. is to be applied to a smooth surface, there can be no motivation based on Bogicevic et al. to provide an interlayer by the claimed method onto an irregular surface of the claimed fuel cell. Certainly not all methods of applying such a layer would give the same result as discussed

above. Therefore, even a combination of the teaching of Ivers-Tiffée et al. with that of Bogicevic et al. does not render the claimed invention obvious.

Since, with respect to the electrolyte boundary layer recited in claim 1, all of the rejections rely on the teaching of Bogicevic et al. in combination with Ivers-Tiffée, the above arguments apply not only to claim 1, but also to the remaining claims which expressly or by reference to claim 1, recite an electrolyte boundary layer.

Even in combination, the teachings of Ivers-Tiffée et al. and Bogicevic et al. do not render the high-temperature solid electrolyte fuel cell recited in present claim 1 obvious. The deficiencies of Ivers-Tiffée et al. and Bogicevic et al. are not remedied by the other references cited. Thus, the subject-matter of the dependent claims as well as the process of present claim 10 also are non-obvious in view of the art cited. It follows then, that no one of the rejections can be sustained.

Each of the rejections is properly withdrawn. To properly determine a *prima facie* case of obviousness, the Examiner “must step backward in time and into the shoes worn by the hypothetical ‘person of ordinary skill in the art’ when the invention was unknown and just before it was made.” M.P.E.P § 2142. This is important as “impermissible hindsight must be avoided and the legal conclusion must be gleaned from the prior art.” *Id.* Four factual inquiries must be made: first, a determination of the scope and contents of the prior art; second, a determination of the differences between the prior art and the claims in issue; third, a determination of level of ordinary skill in the pertinent art; and fourth, an evaluation of evidence of secondary consideration. *Graham v. John Deere*, 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966). Three criteria may be helpful in determining whether claimed subject matter is obvious under 103(a): first, if there is some suggestion or motivation to modify or combine the cited references; second, if there is a reasonable expectation of success; and third, if the prior art references teach or suggest all the claim limitations. *KSR Int’l Co. v. Teleflex, Inc.* No 04-1350 (U.S. Apr. 30, 2007).

The cited references, even in combination, fail to teach or suggest the features of the present invention. Even if one were to combine the teachings, the result still would not be Applicant's invention.

In view of the above remarks, Applicant believes the pending application is in condition for allowance.

PETITION FOR EXTENSION AND FEE AUTHORIZATION

Applicant requests a two month extension for filing the within response. The Commissioner is hereby authorized to charge the extension fee for two-months, large entity, to our Deposit Account, No. 04-1105, Reference 62163(45107). While no further fees are believed to be due, the Commissioner is authorized to charge any fees associated with this submission to Deposit Account, No. 04-1105, Reference 62163(45107). Any overpayment should be credited to said Deposit Account.

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Respectfully submitted,

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